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Sasaki

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(54) **FUEL-FILLING APERTURE OPENING/CLOSING DEVICE**

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USPC 141/302, 348–350, 367; 220/86.2
See application file for complete search history.

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(57) **ABSTRACT**

A fuel-filling aperture open-closing device is provided in one end of a filler pipe communicating with a fuel tank. The open-closing device includes a tube member internally forming a pathway, and connected to one end of the filler pipe; a first valve device provided inside the pathway, and opening a valve by being pressed by a fuel-filling nozzle inserted from an outer end side of the pathway; and a second valve device provided on an outer end side more than the first valve device inside the pathway, and opening a valve by being pressed by the fuel-filling nozzle inserted from the outer end side of the pathway so as to allow the fuel-filling nozzle to pass through. The first valve device opens by a load smaller than that of the second valve device.

6 Claims, 9 Drawing Sheets

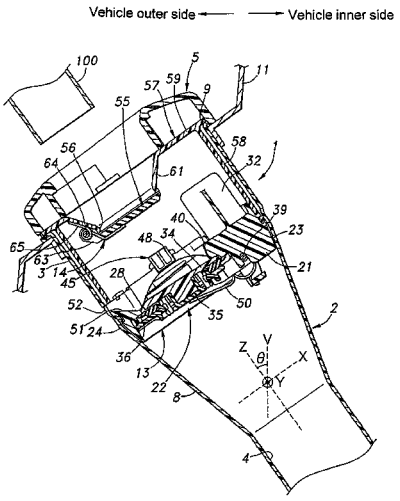

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Fig. 1

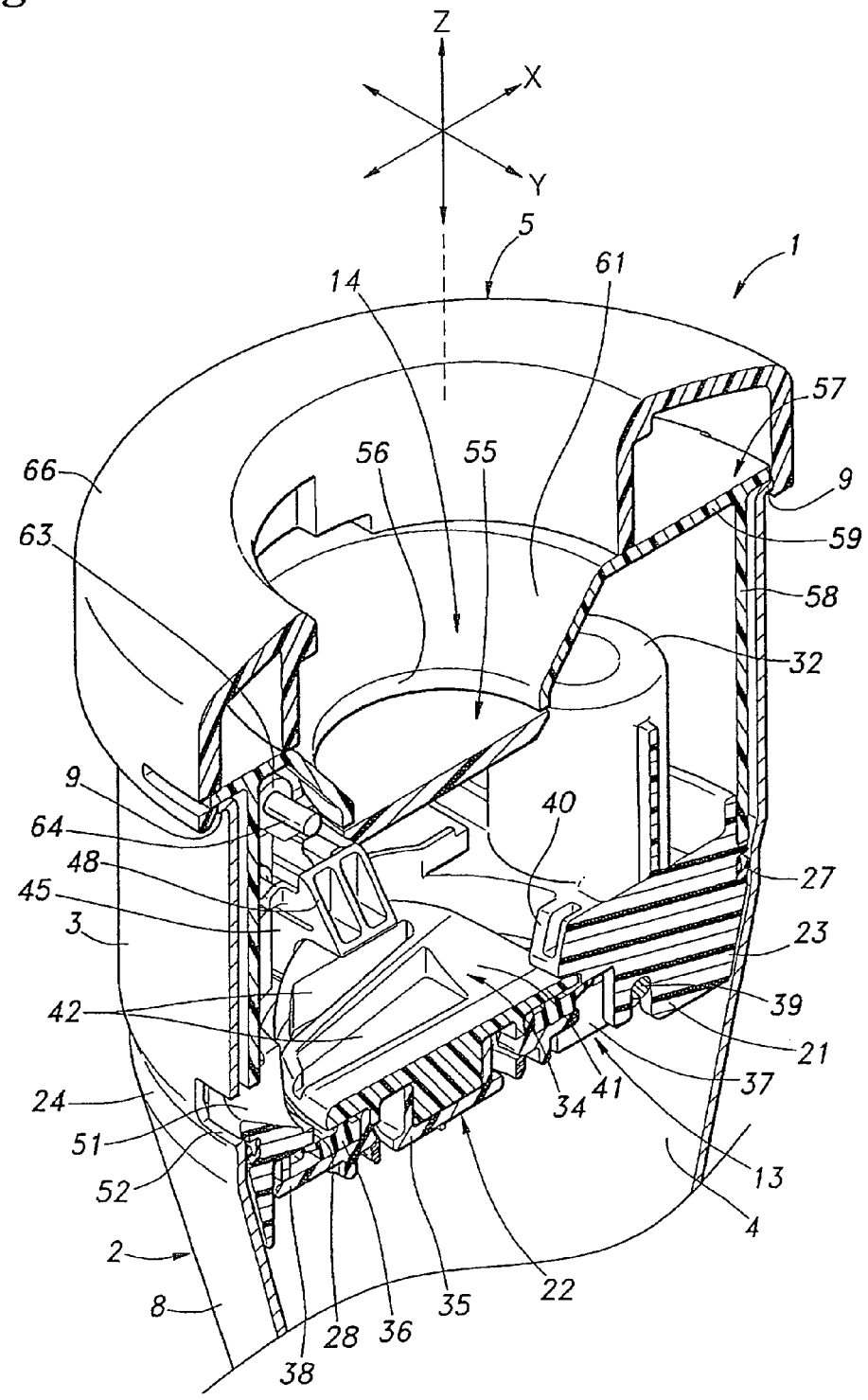
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Fig. 2

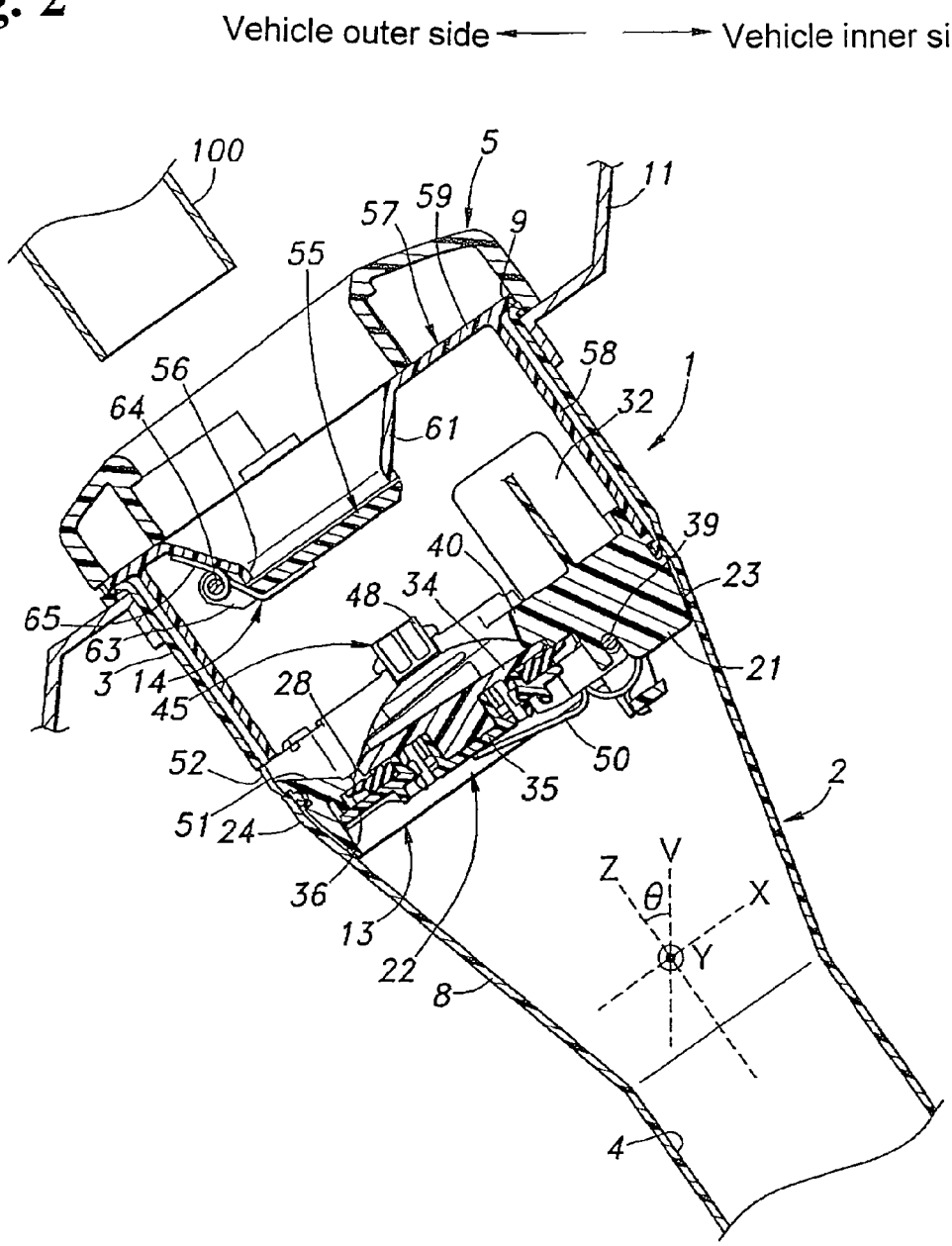
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Fig. 3

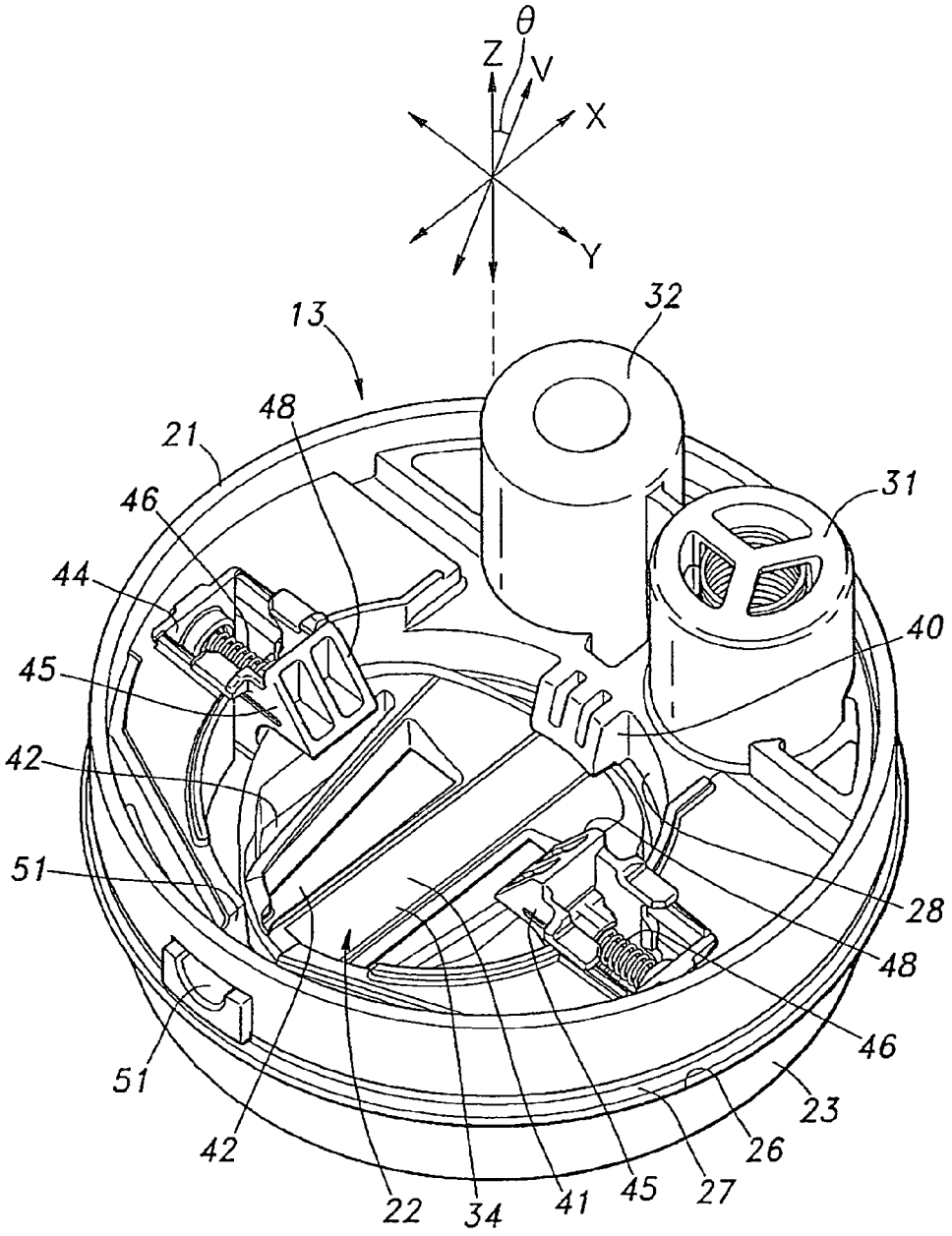
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Fig. 4

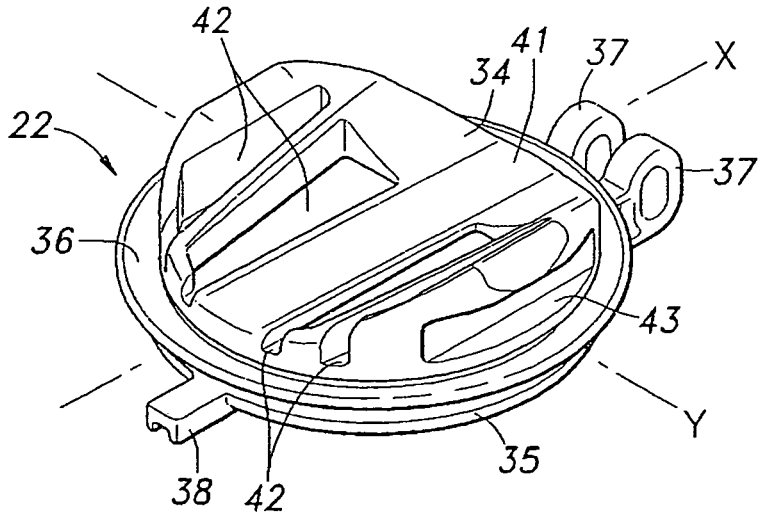

Fig. 5

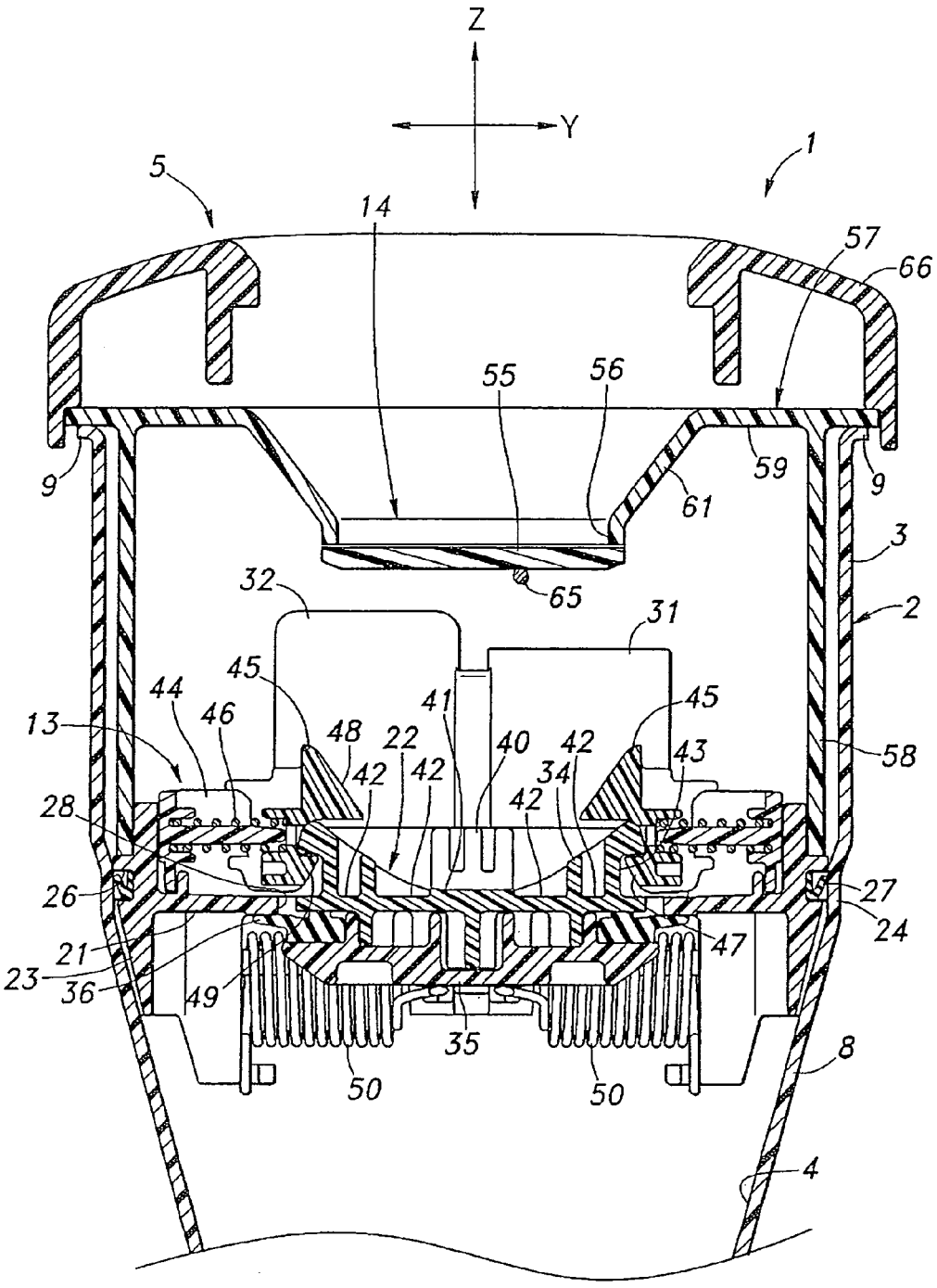
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Fig. 6

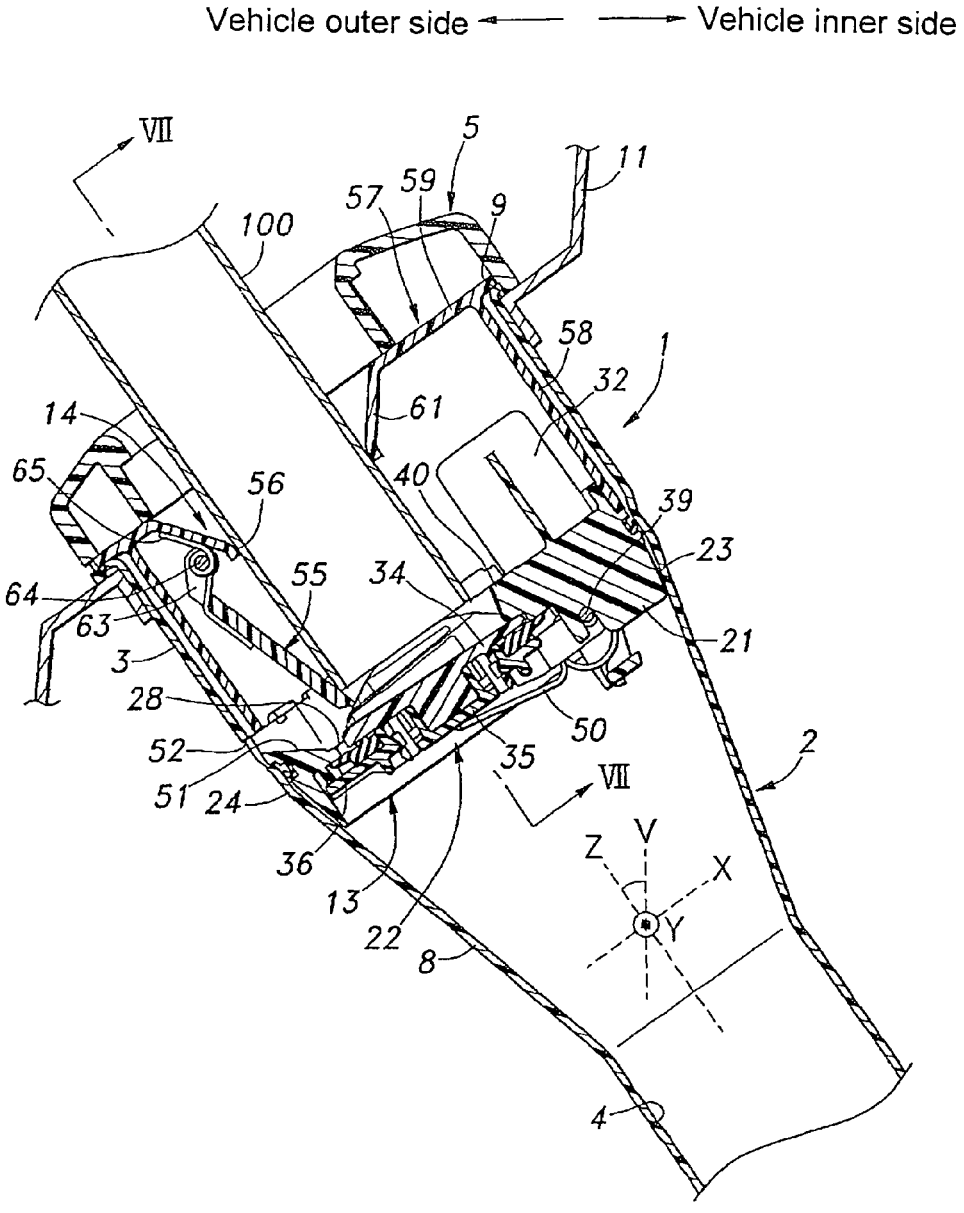
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Fig. 7

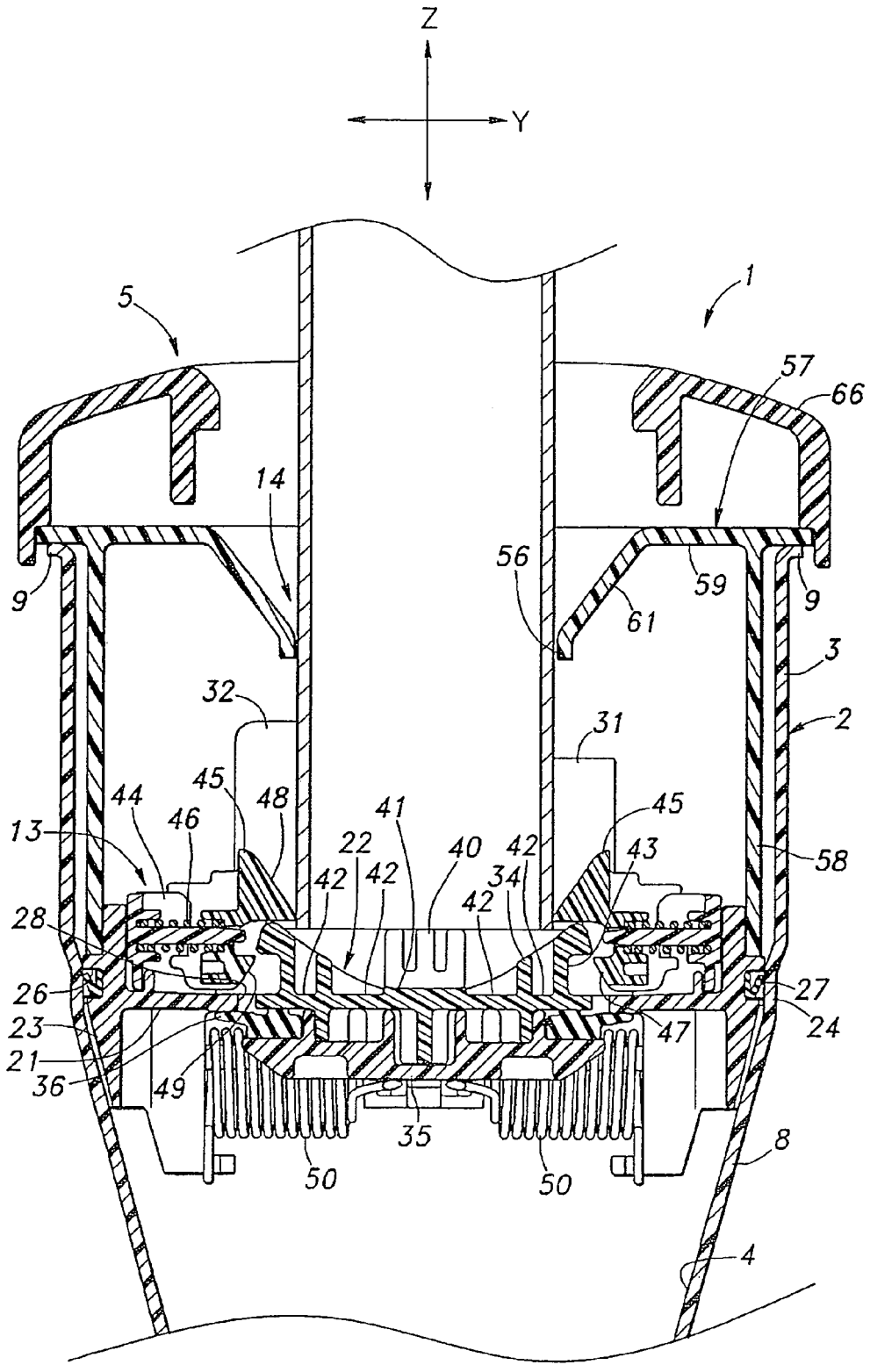
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Fig. 8

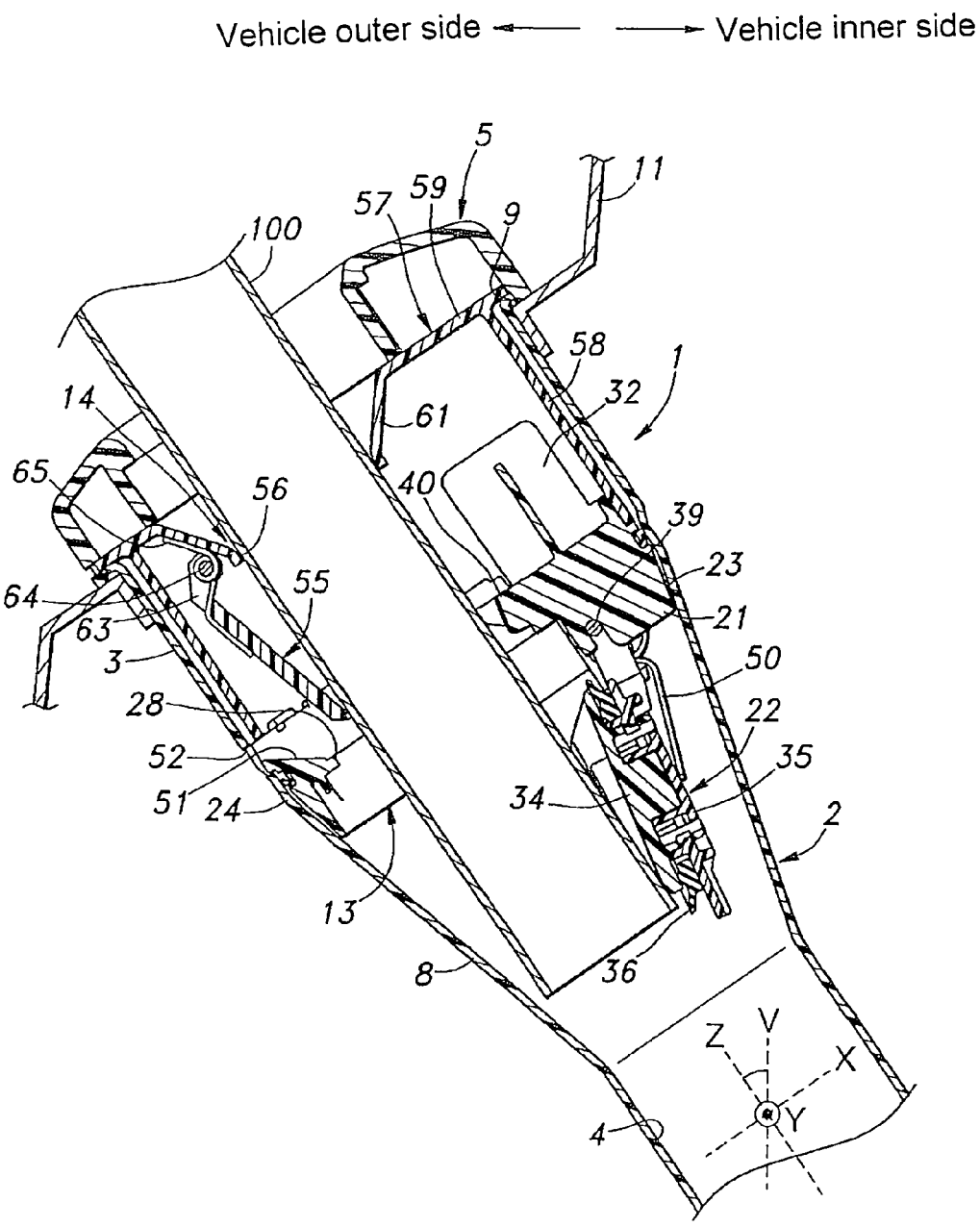
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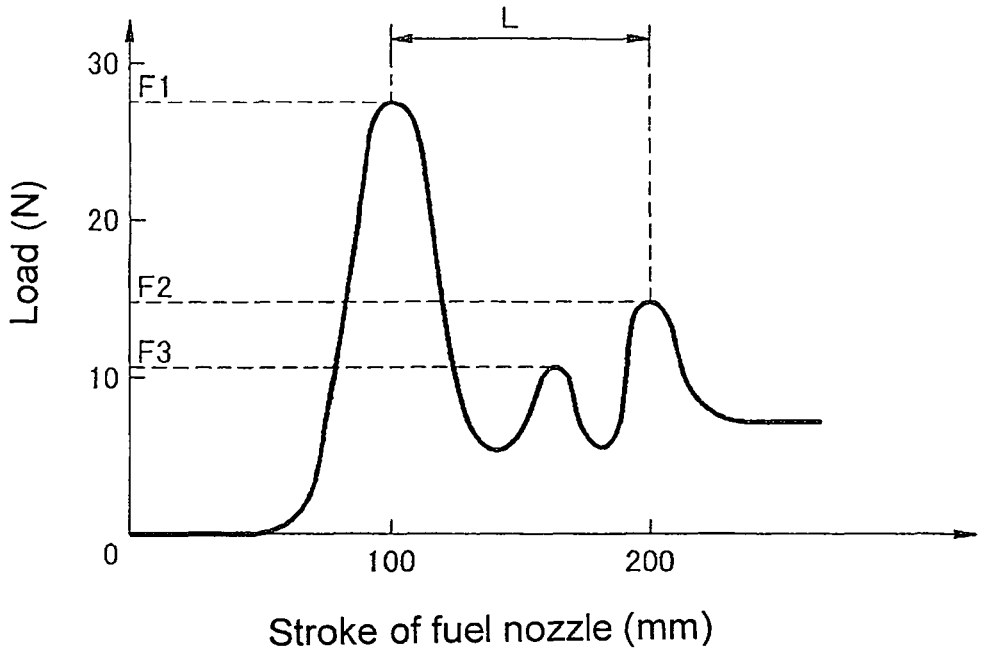
Fig. 9



FUEL-FILLING APERTURE OPENING/CLOSING DEVICE

RELATED APPLICATIONS

The present application is National Phase of International Application No. PCT/JP2012/000032 filed Jan. 5, 2012, and claims priority from Japanese Application No. 2011-023552, filed Feb. 7, 2011.

FIELD OF TECHNOLOGY

The present invention relates to a fuel-filling aperture opening-closing device which opens and closes a fuel-filling aperture of an automobile and the like.

BACKGROUND ART

Conventionally, in the automobile and the like, there is a fuel-filling aperture opening-closing device which blocks the fuel-filling aperture formed in one end of a filler pipe by a screw type filler cap. In such fuel-filling aperture, at each fuel filling, the filler cap has to be removed and put on so as to require additional work. Also, sometimes there occurs a mistake of forgetting to put the removed filler cap. In order to solve the aforementioned problem of the fuel-filling aperture, there is a fuel-filling aperture opening-closing device which openably and closably blocks the fuel-filling aperture by a flap valve, which can be opened by inserting a fuel-filling nozzle (for example, Patent Document 1).

PRIOR ART DOCUMENT

Patent Document

Patent Document 1: Japanese Unexamined Patent Publication No. 2010-195344

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

In the fuel-filling aperture opening-closing device described in the Patent Document 1, however, the flap valve is exteriorly exposed, so that foreign matters such as rainwater, dust, and the like easily remain on an outer surface (a face facing an opening end side of the fuel-filling aperture) of the flap valve, and in a case of push-opening the flap valve disposed inside a pathway by an end of the fuel-filling nozzle, the flap valve opens, and the foreign matters fall into the filler pipe, and are attached to the end of the fuel-filling nozzle, so that there is a possibility that the foreign matters are washed into the filler pipe together with a fuel injection.

As for a method for solving the aforementioned problem, it is thought that providing two flap valves in series makes the foreign matters more difficult to enter into the filler pipe. However, in that case, an insertion resistance of the fuel-filling nozzle increases, so that there might be a problem that a smoothly inserting operation becomes difficult, or a problem that filling a fuel accidentally starts in a state wherein the flap valve on a back side is closed due to a miscalculation of an insertion depth of the fuel-filling nozzle.

The present invention is made in view of the aforementioned background, and an object of the present invention is to facilitate an insertion of the fuel-filling nozzle, and to reliably open two valve bodies by inserting the fuel-filling nozzle in a fuel-filling aperture opening-closing device which opens the two valve bodies by inserting the fuel-filling nozzle.

Means for Solving the Problems

In order to obtain the aforementioned object, the present invention is a fuel-filling aperture open-closing device (**1**) provided in one end of a filler pipe (**2**) and communicating with a fuel tank. The fuel-filling aperture open-closing device (**1**) comprises a tube member (**3**) internally forming a pathway (**4**), and connected to one end of the filler pipe; a first valve device (**13**) provided inside the pathway, and opening a valve by being pressed by a fuel-filling nozzle (**100**) inserted from an outer end side of the pathway; and a second valve body (**14**) provided on an outer end side more than the first valve device inside the pathway, and opening a valve by being pressed by the fuel-filling nozzle inserted from the outer end side of the pathway so as to allow the fuel-filling nozzle to pass through. The first valve device opens the valve by a load smaller than that of the second valve device.

According to the configuration, due to a force (an inertia in an insertion direction) of the fuel-filling nozzle when a second valve body is pushed to open by the fuel-filling nozzle, continuously, a first valve body can be easily pushed to open. Thereby, a condition, wherein though the second valve body is opened, the first valve body remains closed, is difficult to occur.

Another aspect of the present invention is that the first valve device and the second valve device are disposed closely in an axis line direction of the pathway within a range not disturbing a valve-opening movement and a valve-closing movement.

According to the configuration, when the fuel-filling nozzle pushes to open the second valve body, continuously, the first valve body can be easily pushed to open further.

EFFECT OF THE INVENTION

According to the aforementioned configuration, the fuel-filling aperture open-closing device, which opens two valve bodies by inserting the fuel-filling nozzle, facilitates the insertion of the fuel-filling nozzle, and reliably opens the two valve bodies by inserting the fuel-filling nozzle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partially broken perspective view showing a fuel-filling aperture open-closing device.

FIG. **2** is a cross-sectional view showing a state wherein the fuel-filling aperture open-closing device is disposed in an auto body.

FIG. **3** is a perspective view showing a first valve device.

FIG. **4** is a perspective view showing the first valve body.

FIG. **5** is an enlarged cross-sectional view of a main part showing a state wherein the first valve device and a second valve device of the fuel-filling aperture open-closing device are blocked.

FIG. **6** is an enlarged cross-sectional view of the main part showing a state wherein the first valve device of the fuel-filling aperture open-closing device is blocked, and the second valve device is open.

FIG. **7** is a cross-sectional view taken along a line VII-VII in FIG. **6**.

FIG. **8** is an enlarged cross-sectional view of the main part showing a state wherein the first valve device and the second valve device of the fuel-filling aperture open-closing device are open.

FIG. **9** is a graph showing loads applied to a fuel-filling nozzle when the fuel-filling nozzle is inserted.

BEST MODES OF CARRYING OUT THE INVENTION

Hereinafter, with reference to drawings, embodiments of the present invention applied to a fuel-filling aperture open-closing device provided in a fuel-filling aperture of an automobile will be explained in detail. In the following explanation, an up-and-down direction represents a direction along a vertical line V shown in FIG. **2**.

As shown in FIG. **1** and FIG. **2**, a fuel-filling aperture open-closing device **1** is provided in an outer end of a filler pipe **2** connected to a fuel tank which is not shown in the figures; blocks the outer end of the filler pipe **2** at a normal time; and opens the outer end of the filler pipe **2** when a fuel-filling nozzle **100** having an appropriate diameter is inserted. In the filler pipe **2**, as a standard of a longitudinal direction, an end portion side, which becomes the fuel-filling aperture, is made as an outer end side, and an end portion side connected to the fuel tank is made as an inner end side. As shown in FIG. **1**, the fuel-filling aperture open-closing device **1** includes a tube portion (a tube member) **3** forming the outer end of the filler pipe **2**; and a valve device assembly body **5** inserted into an opening end of the tube portion **3**, and openably and closably blocking a pathway **4** formed inside the tube portion **3**.

The filler pipe **2** is a metallic pipe material, and includes an expanding diameter portion **8** having a circular truncated cone shape gradually expanding a diameter as moving to the outer end side. The tube portion **3** continues to the outer end side of the expanding diameter portion **8**. The tube portion **3** has a cylindrical shape, and there is formed the opening end on the outer end side. In the opening end of the tube portion **3**, there is formed an outward flange portion **9**. In the present embodiment, although the tube portion **3** is configured as one portion of the filler-pipe **2**, in another embodiment, the tube portion **3** may be configured in a separate member from the filler pipe **2**, and the tube portion **3** may be combined with the filler pipe **2**. In that case, the tube portion **3** may be formed by a resin material.

As shown in FIG. **2**, given that an axis line of the tube portion **3** is Z, the tube portion **3** is attached to an auto body panel **11** in such a way that an angle θ between the vertical line V and the axis line Z becomes larger than 0 degree. The angle θ is preferred to be, for example, 30 to 80 degrees. Also, for the sake of explanation, a line of intersection between a planar surface (a horizontal cross-sectional surface of the tube portion **3**) orthogonal to the axis line Z and a planar surface including the axis line Z and the vertical line V is made as an axis line X; and a line of intersection between a planar surface orthogonal to the axis line X and a planar surface orthogonal to the axis line Z is made as an axis line Y.

In the valve device assembly body **5**, a first valve device **13** and a second valve device **14**, which are respectively a flap type valve, are disposed in series. In a state wherein the valve device assembly body **5** has been inserted into the opening end of the tube portion **3**, the second valve device **14** is disposed on an outer end side rather than the first valve device **13**.

The first valve device **13** includes a base member **21**, and a first valve body **22** rotatably supported in the base member **21**, as main elements. The base member **21** has a disk shape with a thickness, and an outer circumferential portion **23** thereof is formed in a shape that can be engaged with an inner circumferential surface of a border portion **24** between the tube portion **3** and the expanding diameter portion **8**. Namely, the outer circumferential portion **23** of the base member **21** includes a tapered portion (a circular truncated cone portion) fitting into an inner surface of the expanding diameter portion **8**, and the tapered portion fits into the expanding diameter portion **8** so as to be positioned inside the filler pipe **2**. Also, in the outer circumferential portion **23** of the base member **21**, there is formed an annular seal groove **26** (see FIG. **5**) extending in a circumferential direction, and in the seal groove **26**, there is installed an annular seal member **27**. The seal member **27** seals a gap between the base member **21** and an inner surface of the filler pipe **2** closely.

As shown in FIG. **2** and FIG. **3**, in a state wherein the base member **21** is attached to the filler pipe **2**, in a portion between a lower half portion and a center portion in an axis line X direction of the base member **21**, there is formed a first pathway **28** passing through the base member **21** in a thickness direction (an axis line Z direction). In an upper half portion in the axis line X direction of the base member **21**, there are provided a positive pressure valve **31** and a negative pressure valve **32**. The positive pressure valve **31** and the negative pressure valve **32** respectively include a pathway communicating an inner end side with an outer end side of the base member **21**; a valve seat provided inside the pathway; a valve body seated in the valve seat and blocking the pathway; and a compression coil spring urging the valve body to a valve seat side. In the positive pressure valve **31**, in a case wherein the inner end side of the base member **21** has become a positive pressure with a predetermined value or above, the pressure moves the valve body in a direction separating from the valve seat against an urging force of the compression coil spring to open the pathway so as to decrease the pressure on the inner end side of the base member **21**. On the other hand, in the negative pressure valve **32**, in a case wherein the inner end side of the base member **21** has become a negative pressure with a predetermined value or less, the pressure moves the valve body in the direction separating from the valve seat against the urging force of the compression coil spring to open the pathway so as to increase the pressure on the inner end side of the base member **21**. Due to operations of the positive pressure valve **31** and the negative pressure valve **32**, the inner end side of the base member **21** is prevented from becoming a high pressure with a predetermined value or above, or a low pressure with a predetermined value or less.

The first valve body **22** is used for blocking the first pathway **28**; and is formed by mutually overlapping and combining a first circular plate **34** with a second circular plate **35**. Between the first circular plate **34** and the second circular plate **35**, there is clamped an annular seal member **36** whose outer diameter is larger than that of the first circular plate **34**. An outer circumferential portion of the seal member **36** protrudes outward in a radial direction from circumferential edge portions of the first circular plate **34** and the second circular plate **35** so as to form an annular lip piece having flexibility. Given that each direction is set up as shown in FIG. **3** and FIG. **4** as a standard state wherein the first valve body **22** has blocked the first pathway **28**, in one circumferential edge portion in an axis line X direction of the second circular plate **35**, a pair of bearings **37** project. In the other circumferential edge portion, there is projected a stopper **38** which is a projecting piece. In the pair of bearings **37**, respective axis lines are parallel to the axis line Y direction, and the pair of bearings **37** has the same axis, respectively.

In a portion which is the inner end side of the base member **21**, and which is positioned on an upper side in an axis line X direction of the first pathway **28**, there is provided a support axis **39** extending in the axis line Y direction. The pair of bearings **37** is pivotally supported at the support axis **39**, so that the first valve body **22** is rotatably supported relative to the base member **21**. The first valve body **22** rotates as a

rotation axis of the support axis **39** so as to block the first pathway **28**. In a state of a closed position wherein the first valve body **22** blocks the first pathway **28**, the first circular plate **34** is disposed on an outer end side, and enters into the first pathway **28**. Also, the second circular plate **35** is disposed on an inner end side of the first circular plate **34**, and the seal member **36** abuts against a circumferential edge portion on an inner end side of the first pathway **28** so as to seal a gap between the first circular plate **34** and the first pathway **28**. At that time, the stopper **38** of the second circular plate **35** abuts against an inner end side portion of the first pathway **28**. Also, the first circular plate **34** abuts against a claw portion **40** projecting on a wall surface of the first pathway **28** so as to set the closed position of the first valve body **22**. A first torsion spring **50** is installed between the second circular plate **35** and the base member **21**, and the first valve body **22** is constantly urged to the closed position.

As shown in FIG. **4**, a surface **41** of the first circular plate **34** has a concave surface which increases (protrudes to the outer end side) a thickness as moving to both sides in the axis line Y direction from a center portion. Also, on the surface **41** of the first circular plate **34**, there is formed a plurality of discharge grooves **42** extending in the axis line X direction. Each discharge groove **42** is communicated with an end surface of the first circular plate **34** on a side (i.e., a downside in the axis line X direction of the first valve body **22**) wherein the stopper **38** is provided in the axis line X direction. In each discharge groove **42**, a side (i.e., an upside in the axis line X direction of the first valve body **22**) wherein the bearings **37** are provided in the axis line X direction may be communicated with the end surface of the first circular plate **34**, or as shown in FIG. **4**, may form a terminal end in the center portion of the first circular plate **34**. On both end surfaces in the axis line Y direction of the first circular plate **34**, there are respectively formed engagement holes **43** concaved to a center side of the first circular plate **34**.

In an outer end side portion of the base member **21**, there is formed a pair of guide grooves **44** communicating in such a way as to sandwich from the axis line Y direction in an outer end side portion of the first pathway **28**. In the guide groove **44**, a lock member **45** is slidably provided along the guide groove **44**. In the axis line Y direction, the lock member **45** can slide between a position wherein one portion of the lock member **45** protrudes into the first pathway **28** and a position wherein the whole lock member **45** enters into the guide groove **44**. Also, inside the guide groove **44**, there is provided a compression coil spring **46**, and the lock member **45** is constantly urged to a first pathway **28** side by the compression coil spring **46**.

In a portion facing the first pathway **28** side of the lock member **45**, there is formed an engagement convex portion **47** which can enter into the engagement hole **43** of the first circular plate **34**. Also, in portions facing the first pathway **28** side of the lock member **45**, and on an outer end side and an inner end side of the engagement convex portion **47**, there are formed cam portions **48** and **49** which have tapered surfaces. In a case wherein the first valve body **22** is in the closed position, the lock member **45** engages with the engagement hole **43** of the first valve body **22** in the engagement convex portion **47** so as to control the first valve body **22** in the closed position. On the other hand, when the lock member **45** receives a load to the inner end side in the cam portion **48**, the lock member **45** moves backward in a direction entering into the guide groove **44** to release an engagement between the engagement convex portion **47** and the engagement hole **43** so as to allow a rotation of the first valve body **22**.

In an outer end side portion of the base member **21**, there is formed a discharge pathway **51** extending in the axis line X direction to communicate a lower portion in the axis line X direction of the first pathway **28** with the outer circumferential portion **23** of the base member **21**. The discharge pathway **51** is formed in a groove shape wherein a portion communicating with the first pathway **28** is open to the outer end side. As shown in FIG. **1** and FIG. **2**, in a portion opposed to the discharge pathway **51** of the filler pipe **2**, there is formed a discharge hole **52** which is a through-hole. Due to the aforementioned configuration, inside the filler pipe **2**, a liquid, which has entered up to an outer end side surface of the base member **21**, flows downward in the axis line X direction due to an inclination of the base member **21**, and is collected in the discharge pathway **51** so as to be discharged to an outside of the filler pipe **2** through the discharge hole **52**. The first pathway **28** blocked by the first valve body **22** forms a concave portion in the outer end side portion of the base member **21**. However, the discharge pathway **51** is communicated with the first pathway **28**, so that the liquid collected in the first pathway **28** can be reliably discharged through the discharge pathway **51** as well.

The second valve device **14** includes a second valve body **55**, and a casing **57** including a second pathway **56** blocked by the second valve body **55**. The casing **57** includes a cylindrical portion **58** formed in a size that can be inserted in the same axis as the tube portion **3** of the filler pipe **2**. An inner end side edge portion of the cylindrical portion **58** is combined with an outer end side portion of the outer circumferential portion **23** of the base member **21**, and in an outer end side edge portion, there is formed a bulkhead portion **59** forming the second pathway **56**. The bulkhead portion **59** has a disk shape extending along a surface orthogonal to the axis line Z, and a circumferential edge portion thereof protrudes outward in a radial direction more than an outer circumferential surface of the cylindrical portion **58**, and abuts against the flange portion **9** on the outer end of the filler pipe **2**. The second pathway **56** is a circular through-hole formed in a protruding end of a guide portion **61** bulged in a circular truncated cone shape from the bulkhead portion **59** to an inner end side, and is disposed in a position which becomes the same axis as the first pathway **28** from a view in a direction along the axis line Z. A diameter of the second pathway **56** is set smaller than a diameter of the first pathway **28**. The guide portion **61** has a function guiding the fuel-filling nozzle **100** inserted from the outside of the filler pipe **2** to the second pathway **56**.

The second valve body **55** is a disk-shaped member comprising a bearing **63** in a circumferential edge portion, and the bearing **63** is pivotally supported at a support axis **64** provided in an inner end side portion of the bulkhead portion **59** so as to be rotatably supported in the casing **57**. The second valve body **55** can rotate between a closed position blocking the second pathway **56** by abutting against a circumferential edge portion on the inner end side of the second pathway **56**, and an open position which does not overlap with the second pathway **56** from the view in the direction along the axis line Z. Also, a second torsion spring **65** is installed between the second valve body **55** and the bulkhead portion **59**, and the second valve body **55** is constantly urged to the closed position.

On an outer end side of the bulkhead portion **59**, there is attached an annular garnish **66** whose inner diameter roughly corresponds to an outer diameter of the guide portion **61**, and whose outer diameter roughly corresponds to an outer diameter of the bulkhead portion **59**. The garnish **66** enhances a design property of the fuel-filling aperture open-closing device **1**, and protects the bulkhead portion **59**.

In the present embodiment, the first valve device **13** and the second valve device **14** are formed by a resin material except for the compression coil springs **46**, a first torsion spring **50**, and the second torsion spring **65**. The first valve device **13** and the second valve device **14** form the valve device assembly body **5** as one unit combined beforehand, and the valve device assembly body **5** is inserted into the tube portion **3** of the filler pipe **2** so as to form the fuel-filling aperture open-closing device **1**. In another embodiment, the tube portion **3** may be configured as a resin molded article of the separate member from the filler pipe **2**, and the fuel-filling aperture open-closing device **1** may be configured by combining the first valve device **13**, the second valve device **14**, and the tube portion **3** beforehand, so that the fuel-filling aperture open-closing device **1** may be connected to the outer end of the filler pipe **2**.

A distance in an axis line Z direction between the first valve device **13** and the second valve device **14** is arranged by being approached within a range wherein a rotation of the second valve body **55** is not disturbed by the first valve device **13** (i.e., there is no first valve device **13** inside a rotation trajectory of the second valve body **55**).

Next, with reference to FIG. **5** to FIG. **8**, a movement of the fuel-filling aperture open-closing device **1** will be explained. As shown in FIG. **5** (FIGS. **1** and **2**), in a normal state wherein filling a fuel is not carried out by the fuel-filling nozzle **100**, the first valve body **22** is urged by the first torsion spring **50** so as to block the first pathway **28**, and the second valve body **55** is urged by the second torsion spring **65** so as to block the second pathway **56**. Also, the pair of lock members **45** is urged by the compression coil springs **46**, and is engaged with the first valve body **22** so as to control the rotation of the first valve body **22**.

From the aforementioned normal state, in a case of injecting a fuel, i.e., filling a fuel into the filler pipe **2** using the fuel-filling nozzle **100**, the cylindrical fuel-filling nozzle **100** is inserted into the second pathway **56** and the first pathway **28** of the fuel-filling aperture open-closing device **1**. At first, the second valve body **55** is pressed by an end of the fuel-filling nozzle **100**, and is rotated against an urging force of the second torsion spring **65**, and while opening the second pathway **56**, the fuel-filling nozzle **100** is inserted to pass through the second pathway **56**. At that time, the second pathway **56** is set in a predetermined diameter so as to prevent an insertion of the fuel-filling nozzle **100** whose outer diameter is larger than that of the second pathway **56**.

When the fuel-filling nozzle **100** is further inserted into an inner end side, the end of the fuel-filling nozzle **100** abuts against the cam portion **48** of the pair of lock members **45**. From this state, when the fuel-filling nozzle **100** is further inserted into the inner end side, as shown in FIG. **6** and FIG. **7**, the lock member **45** receives a load in the direction entering into the guide groove **44** from the fuel-filling nozzle **100** through the cam portion **48** so as to slide into the guide groove **44** against an urging force of the compression coil spring **46**. Thereby, the engagement between the engagement convex portion **47** and the engagement hole **43**, i.e., an engagement between the lock member **45** and the first valve body **22** is released so as to allow the rotation of the first valve body **22**. Incidentally, in a case wherein the outer diameter of the fuel-filling nozzle **100** is smaller than a predetermined value, both of the pair of lock members **45** cannot move backward into the guide groove **44**, so that a lock of the first valve body **22** by the lock member **45** cannot be released. The diameter of the fuel-filling nozzle **100** is controlled to a certain size or less by the second pathway **56**, and is controlled to a certain size or above by the pair of lock members **45**, so that only the fuel-filling nozzle **100** having a predetermined diameter can open the fuel-filling aperture open-closing device **1**.

After the engagement between the pair of lock members **45** and the first valve body **22** is released, when the fuel-filling nozzle **100** is further inserted into the inner end side, as shown in FIG. **8**, the fuel-filling nozzle **100** presses the first valve body **22** by the end thereof, rotates the first valve body **22** against an urging force of the first torsion spring **50**, and while opening the first pathway **28**, the fuel-filling nozzle **100** enters into the first pathway **28**. At that time, an extending direction of the discharge groove **42** and a sliding direction of the fuel-filling nozzle **100** on the surface **41** of the first valve body **22** correspond, so that the fuel-filling nozzle **100** smoothly slides on the surface **41** without being caught in the discharge groove **42**. In a state wherein the end of the fuel-filling nozzle **100** has passed the first pathway **28**, filling a fuel is carried out from the fuel-filling nozzle **100**.

When the fuel-filling nozzle **100** is pulled out of the fuel-filling aperture open-closing device **1**, accompanied by a displacement of the fuel-filling nozzle **100** to an outer end side, the first valve body **22** is urged by the first torsion spring **50**, moves to the closed position, and closes the first. pathway **28**. Also, the pair of lock members **45** receives an urging force of the compression coil spring **46** so as to protrude to the first pathway **28** side, and the engagement convex portion **47** engages with the engagement hole **43** so as to lock the first valve body **22**. Then, the second valve body **55** is urged by the second torsion spring **65**, moves to the closed position, and closes the second pathway **56** so as to return to the normal state. Incidentally, in a case wherein the fuel-filling nozzle **100** is pulled out quickly, before the first valve body **22** reaches the closed position, the pair of lock members **45** could come to a state protruding into the first pathway **28**. However, in that case, the first valve body **22** presses the cam portion **49** of each lock member **45**, and moves to the closed position while moving each lock member **45** backward into the guide groove **44**. After that, each lock member **45** protrudes again, and the engagement convex portion **47** engages the engagement hole **43**.

An operational-effect of the fuel-filling aperture open-closing device **1** according to the present embodiment will be explained. The fuel-filling aperture open-closing device **1** does not include a screw type filler cap such as a conventional fuel-filling aperture, and can open the fuel-filling aperture only by inserting the fuel-filling nozzle **100**, so that a fuel-filling operation can be easily carried out. Also, two valves of the first valve device **13** and the second valve device **14** are disposed in series so as to prevent foreign matters such as dust, rainwater, and the like from an outside from entering into the filler pipe **2**. Also, the axis line Z of the tube portion **3** of the filler pipe **2** is inclined relative to the vertical line V, and in a portion facing a lower side of a lateral circumferential portion, and corresponding to the outer end side of the base member **21**, there are provided the discharge pathway **51** and the discharge hole **52** so as to discharge the foreign matters, which have passed the second valve body **55** and have remained in an outer end side portion of the first valve device **13**, to the outside of the filler pipe **2** from the discharge hole **52**. Especially, the first valve body **22** includes the discharge groove **42** on the surface **41**, so that the foreign matters are appropriately guided to the discharge pathway **51** and a discharge hole **52** side. Due to the aforementioned configurations, the fuel-filling aperture open-closing device **1** can open the second valve body **55** so as to wash the outer end side portion of the first valve device **13** by a water flow and the like.

Also, the first valve body **22** includes the discharge groove **42** on the surface **41**, so that when the fuel-filling nozzle **100**

opens the first valve body **22**, an area wherein the end of the fuel-filling nozzle **100** slidingly contacts with the surface **41** of the first valve body **22** is reduced. Consequently, a possibility that the fuel-filling nozzle **100** completely takes out the foreign matters attached to the surface **41** of the first valve body **22** is reduced so as to prevent the foreign matters from being brought into the inner end side of the first pathway **28** by the fuel-filling nozzle **100**.

FIG. **9** is a graph showing loads where the fuel-filling nozzle **100** receives from the fuel-filling aperture open-closing device **1** when the fuel-filling nozzle **100** is inserted into the fuel-filling aperture open-closing device **1**. As shown in FIG. **9**, when the fuel-filling nozzle **100** is inserted into the fuel-filling aperture open-closing device **1**, given that the loads, where the fuel-filling nozzle **100** receives toward the outer end side in the axis line Z direction from the second valve body **55**, the pair of lock members **45**, and the first valve body **22**, are F**1**, F**2**, and F**3**, ease of opening the second valve body **55**, the pair of lock members **45**, and the first valve body **22** is set to become F**1**>F**2** and F**1**>F**3**. The amounts of the loads, provided to the fuel-filling nozzle **100** from the second valve body **55**, the pair of lock members **45**, and the first valve body **22**, are set mainly by changing spring constants of the second torsion spring **65**, the compression coil spring **46**, and the first torsion spring **50**. By satisfying the aforementioned relationship of the loads F**1**, F**2**, and F**3**, a user (a fuel-filler) can move the pair of lock members **45** backward, and at the same time, can open the first valve body **22**, with a time when the fuel-filling nozzle **100** is inserted to open the second valve body **55**. Namely, a user becomes difficult to sense a resistance of the pair of lock members **45** and the first valve body **22**, and by a single inserting operation, the fuel-filling nozzle **100** can be easily opened up to the first valve body. **22**. Thereby, when a user inserts the fuel-filling nozzle **100**, it is difficult to become a condition, wherein the first valve body **22** has not been opened though the second valve body **55** has been opened. Accordingly, it is difficult for filling a fuel, while the first valve body **22** has been closed, i.e., in a state wherein the fuel-filling nozzle **100** has not passed the first pathway **28**.

It is preferred that the loads F**2** and F**3** are one-half or less of the load F**1**, and it is furthermore preferred that the loads F**2** and F**3** are one-third or less of the load F**1**. For example, the load F**1** is 20 to 30 N, and the loads F**2** and F**3** are approximately 10 N.

When the fuel-filling nozzle **100** is inserted into the fuel-filling aperture open-closing device **1**, in order to easily open up to the first valve body **22** at once when the second valve body **55** is opened, shorter strokes (moving distances) L of the fuel-filling nozzle **100**, up to a position wherein the load F**3** is applied from a position wherein the load F**1** is applied, are preferred. Also, further preferably, shapes and relative positions of the second valve body **55** and the lock members **45** may be set in such a way that the pair of lock members **45** start to move backward before the second valve body **55** is completely opened.

The explanation of the specific embodiments has been completed here; however, the present invention is not limited to the embodiments described hereinabove, and can be widely modified. For example, the lock members **45** may be omitted in another embodiment.

Explanation Of Symbols

1 . . . a fuel-filling aperture open-closing device, **2** . . . a filler pipe, **3** . . . a tube portion, **4** . . . a pathway, **5** . . . a valve device assembly body, **11** . . . an auto body panel, **13** . . . a first valve device, **14** . . . a second valve device, **21** . . . a base member, **22** . . . a first valve body (a valve body), **28** . . . a first pathway, **42** . . . discharge grooves, **43** . . . engagement holes, **45** . . . lock members, **46** . . . compression coil springs, **47** . . . an engagement convex portion, **50** . . . a first torsion spring, **51** . . . a discharge pathway, **52** . . . a discharge hole, **55** . . . a second valve body (an auxiliary valve body), **56** . . . a second pathway, **65** . . . a second torsion spring, **66** . . . a garnish, **100** . . . a fuel-filling nozzle

What is claimed is:

1. A fuel-filling aperture opening-closing device provided in one end of a filler pipe communicating with a fuel tank, comprising:

a tube member internally forming a pathway, and connected to one end of the filler pipe;

a first flap valve device provided inside the pathway, and opening a first valve by pressing a fuel-filling nozzle inserted from an outer end side of the pathway, the first flap valve device having a first torsion spring urging the first valve so as to close the first valve; and

a second flap valve device provided on the outer end side more than the first flap valve device inside the pathway, and opening a second valve by pressing the fuel-filling nozzle inserted from the outer end side of the pathway so as to allow the fuel-filling nozzle to pass through, the second flap valve device having a second torsion spring urging the second valve so as to close the second valve,

wherein the first torsion spring has a first predetermined spring constant,

the second torsion spring has a second predetermined spring constant,

the first predetermined spring constant and the second predetermined spring constant are adjusted such that the first flap valve device opens by a load smaller than that of the second flap valve device,

the first flap valve device and the second flap valve device are disposed closely in an axis line direction of the pathway within a range not disturbing a valve-opening movement and a valve-closing movement,

the first flap valve device further includes:

a base member in which the first valve is rotatably supported, attached to the filler pipe,

a pair of guide grooves each on an outer side portion of the base member, each of the pair of guide grooves facing each other,

a pair of coil springs each provided in each of the pair of guide grooves,

a pair of lock members each slidably provided along each of the pair of guide grooves, and

another pathway passing through the base member in a thickness direction of the base member, and

each of the pair of lock members is urged to a side of the another pathway by each of the pair of coil springs,

the first valve comprises a seal member on a peripheral edge thereof, a first circular plate on a side facing the second flap type valve device, and a second circular plate mutually overlapping with the first circular plate,

the first circular plate has a concave surface which increases a thickness towards outer end sides thereof, and

the second valve does not have any seal member.

2. The fuel-filling aperture opening-closing device according to claim **1**, wherein each of the pair of coil springs has a third predetermined spring constant, and is configured such that when the fuel-filling nozzle is inserted from the outer end side of the pathway, loads that the fuel-filling nozzle receives toward the outer end side in a longitudinal direction of the pathway from the second valve, the pair of lock members, and the first valve are Fl, F**2**, and F**3**, respectively, and

the first predetermined spring constant, the second predetermined spring constant, and the third predeteiinined spring constant are adjusted to satisfy F1>F2 and F1>F3.

3. The fuel-filling aperture opening-closing device according to claim 1, wherein the first flap type valve device further comprises a pair of engagement convex portions under each of the pair of lock members, in a portion facing the another pathway,

the first valve further comprises a pair of engagement holes under the concave surface, and

each of the pair of engagement convex portions engages with each of the pair of engagement holes.

4. The fuel-filling aperture opening-closing device according to claim 1, wherein the first circular plate comprises a plurality of discharge grooves extending in a direction orthogonal to a direction connecting the pair of guide grooves facing each other and communicating with an end surface of the first circular plate.

5. The fuel-filling aperture opening-closing device according to claim 1, wherein the seal member is disposed between the first circular plate and the second circular plate.

6. The fuel-filling aperture opening-closing device according to claim 5, wherein the seal member is annular and has an outer diameter protruding radially outwardly from edges of the first and second circular plates to form an annular lip piece having flexibility.

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